Swimmer

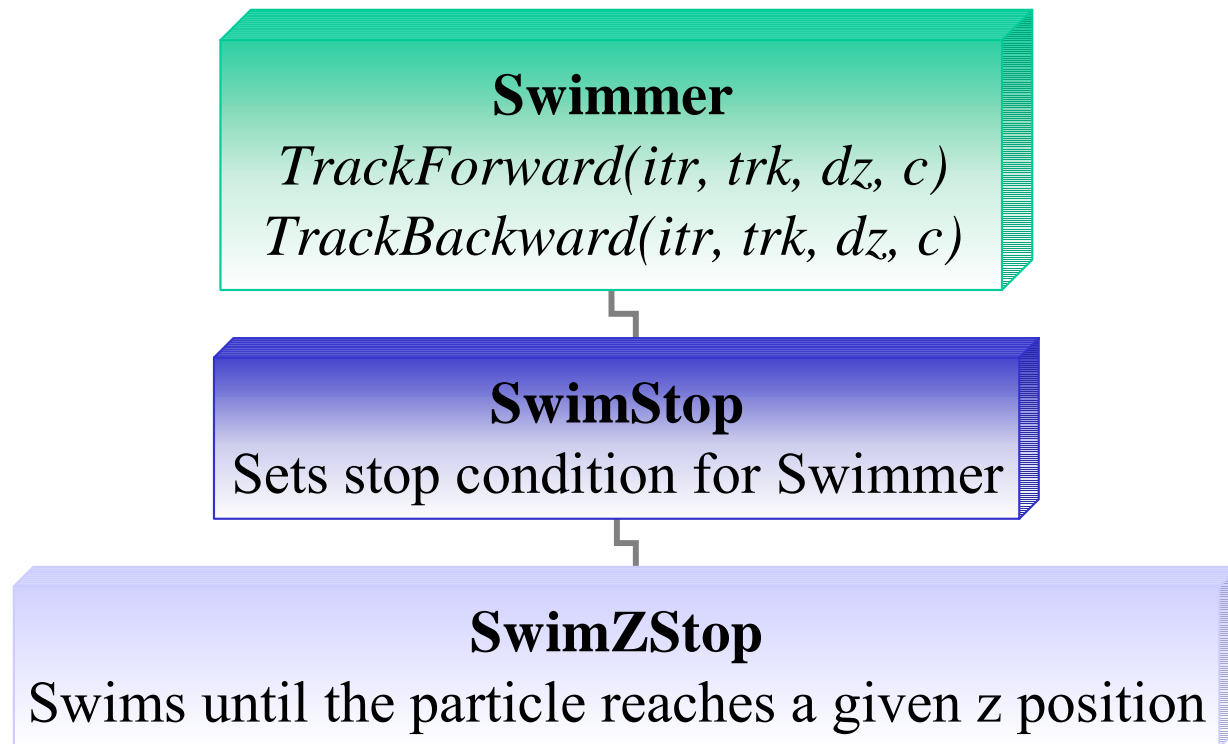## Fermilab Meeting, Nov 2003
Sin Man Seun (Sharon)

- Propagate particles through magnetic field
- Needed for reconstruction
- Use algorithm in Ed Hartouni's note, "Charged Particle Tracking Through Magnetic Field"
    - Assume no energy loss
    - Advantage: require only two magnetic field values per step

Organization

Swimmer
TrackForward(itr, trk, dz, c)
TrackBackward(itr, trk, dz, c)

SwimStop
Sets stop condition for Swimmer

SwimZStop
Swims until the particle reaches a given z position

Sample Code

```cpp
// Make a track and initialize its first point
RBTrack track;
int charge = -1;
double m = 0.105658357;  // in GeV
double px = 0.0;              // in GeV
double py = 1.0;              // in GeV
double pz = 1.0;              // in GeV
// Add an initial point at (0,0,0)
track.push_back(RBTrackPoint(charge, mass, 0, 0, 0, px, py, pz));
RBTrack::iterator itr(track.begin());

magnetfield field("JGG");  // Create a magnetic field

Swimmer s(&field);         // Make a swimmer object
SwimZStop c(50.);          // Stop the swim when z > 50m
double dz = 0.01;          // Stepsize = 1cm

int nstep = s.TrackForward(itr, track, dz, c);
```

Test 1: μ⁻ in a constant BField

Cyclotron radius: $r = \dfrac{p}{0.3\,B} = 0.3$ m   (assume v ⊥ B)

A muon- with py=pz=1GeV and Bz=1Tesla
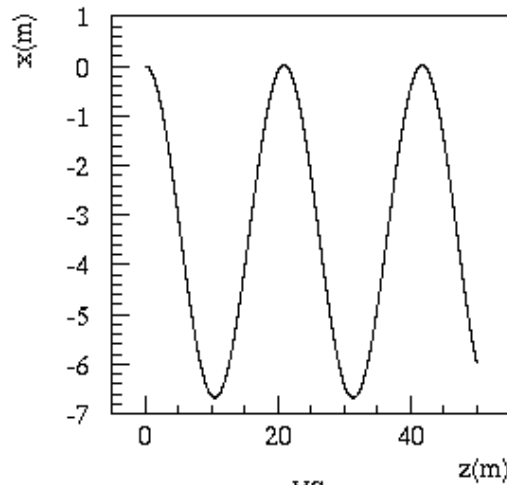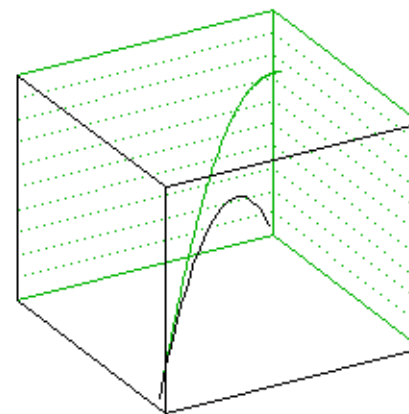

x VS. z
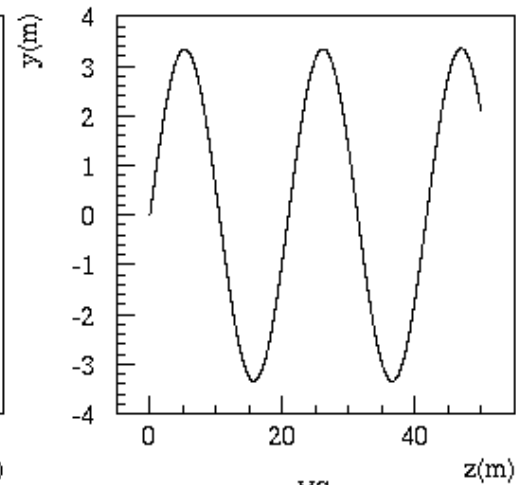
y VS. z
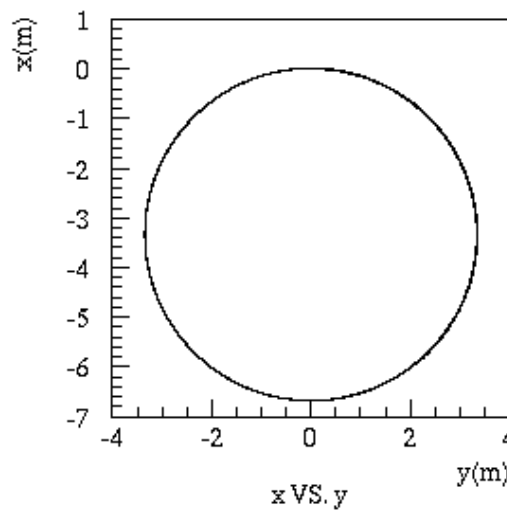
x VS. y
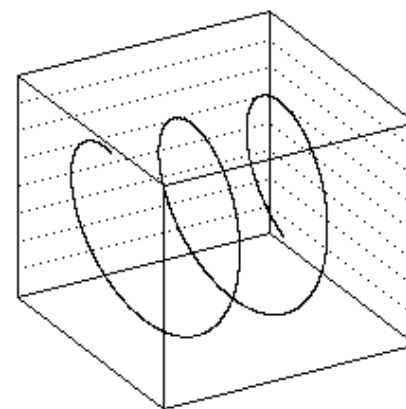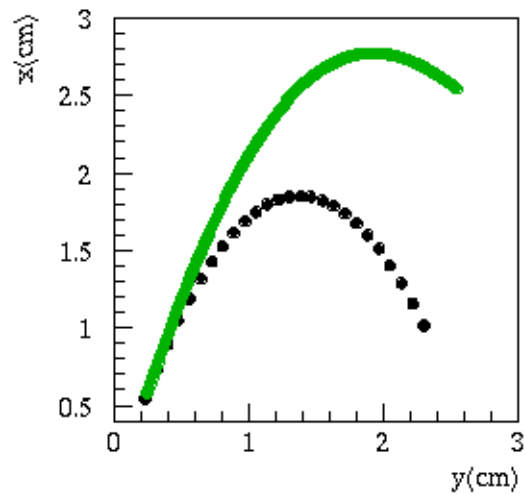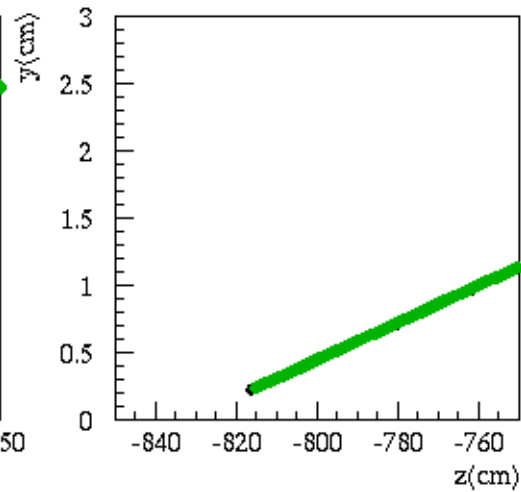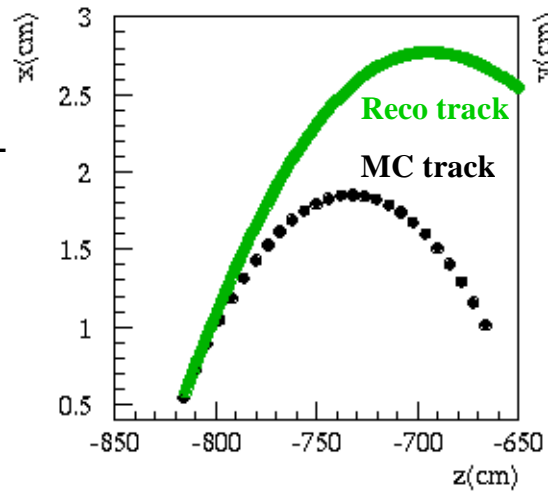
x VS. y VS. z

Test 2: μ⁺ in JGG BField

A muon+ in JGG Bfield (black --MC; green -- RECO [assume particle is mu-])

Reco track is μ⁻

MC track is μ⁺
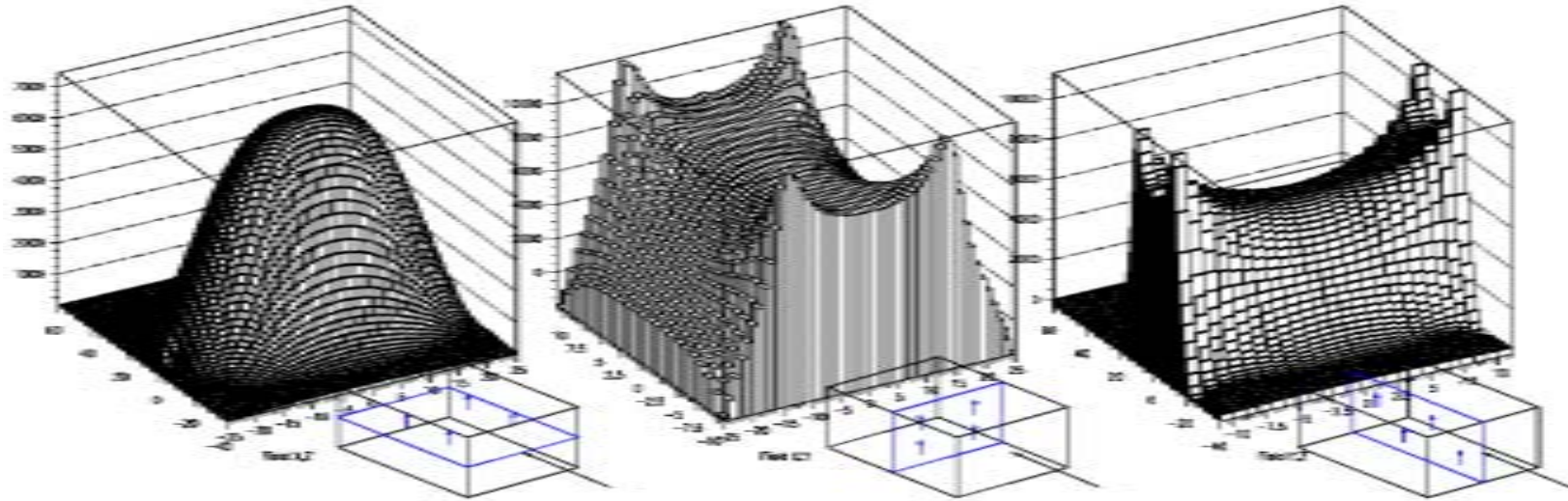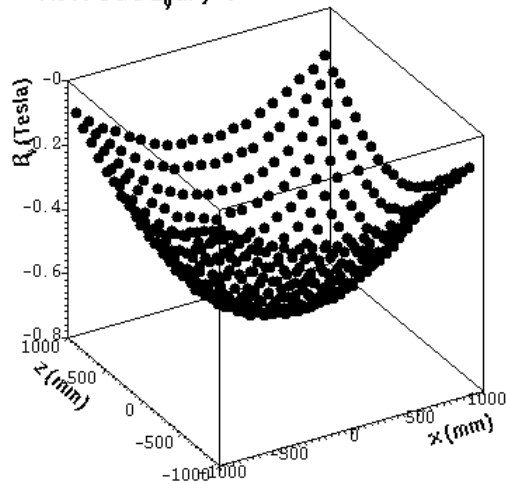

x VS. y VS. z

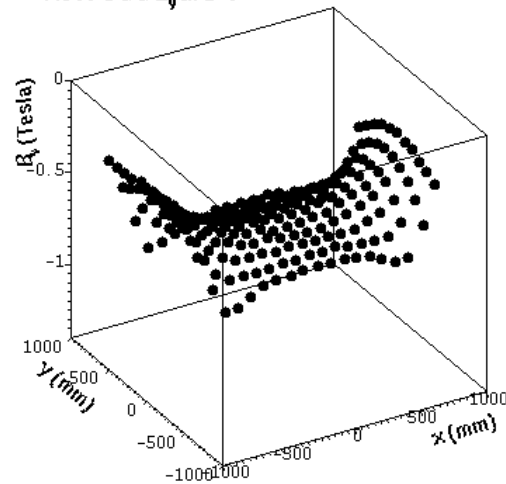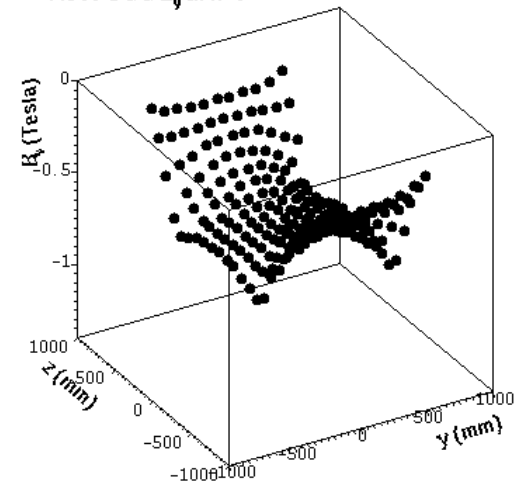# JGG Field Plot Comparison B$_y$

Holger Meyer, Feb 8, 2003

y=0   z=0   x=0

Reco JGG B$_y$ field

Reco JGG B$_y$ at y=0   Reco JGG B$_y$ at z=0   Reco JGG B$_y$ at x=0

JGG Field Plot Comparison B_y
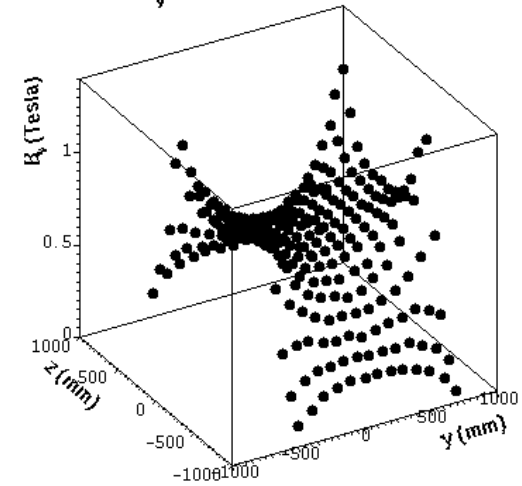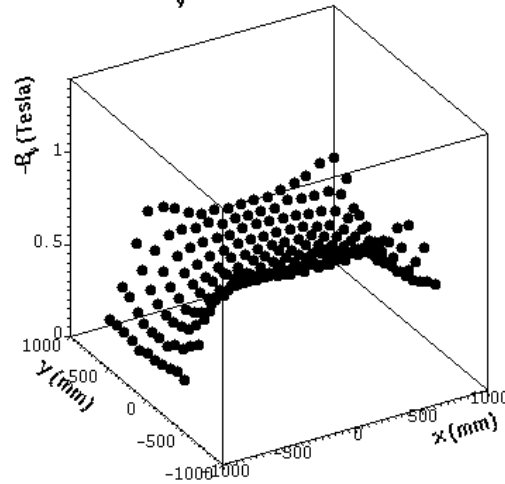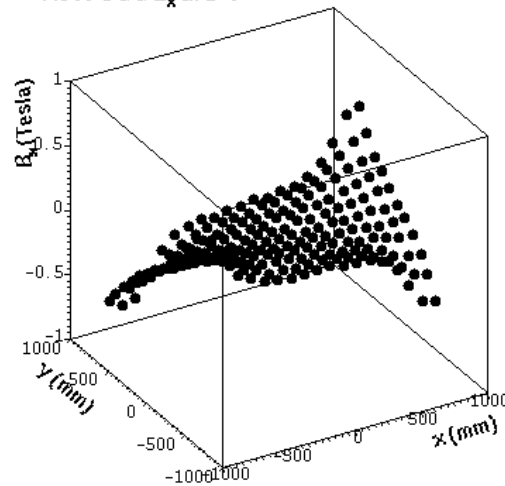
$MC\ B_y \neq Reco\ B_y$

MC JGG B_y field

y=0

z=0

x=0
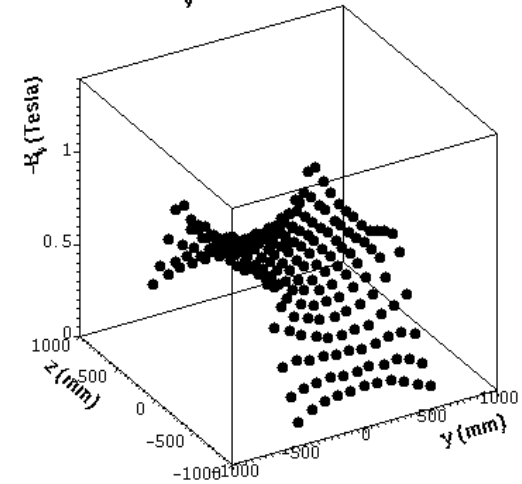
Reco JGG -B_y field

JGG Field Plot Comparison B_x

MC $B_x \neq$ Reco B_x

MC JGG B_x field
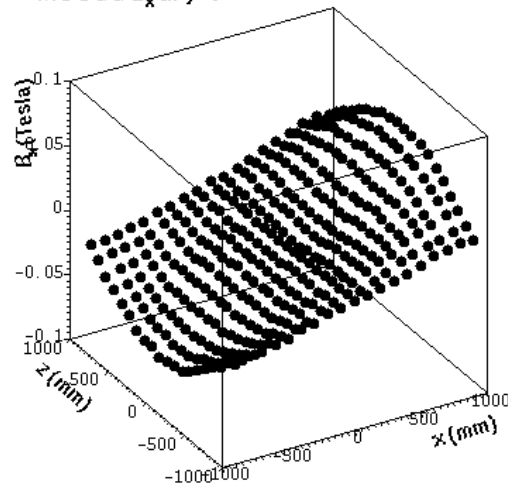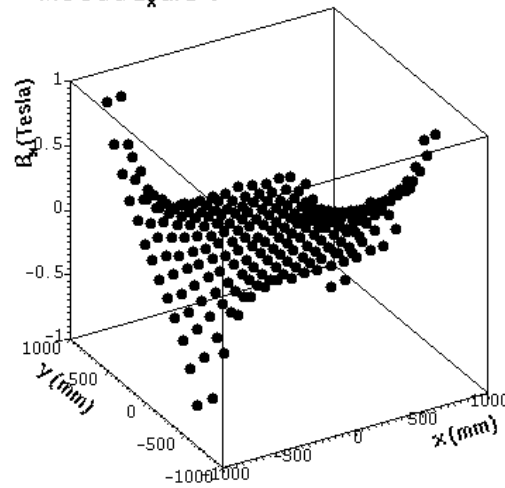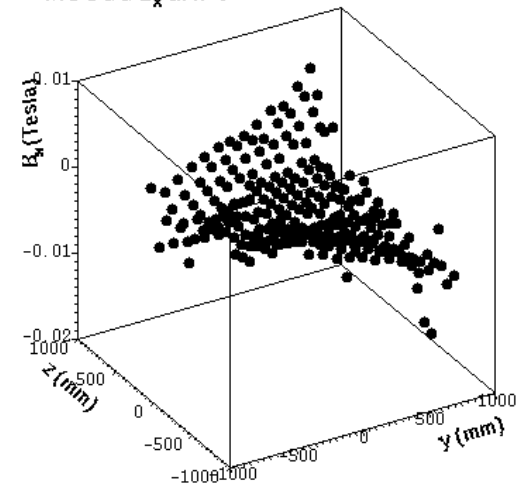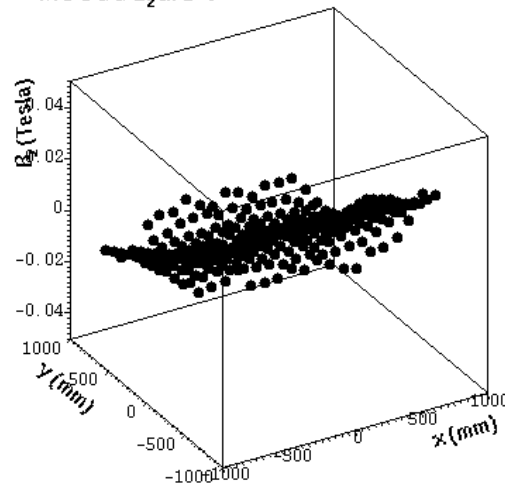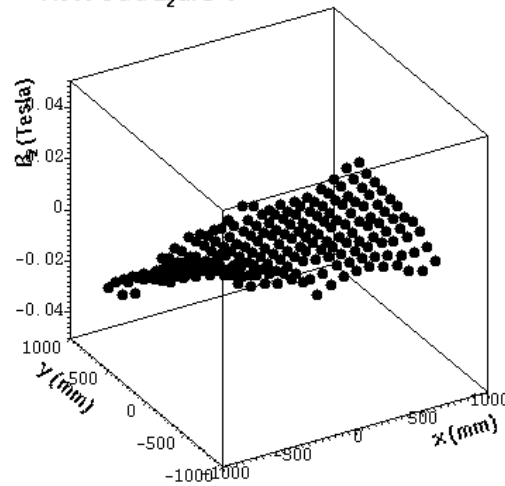

y=0

z=0

x=0
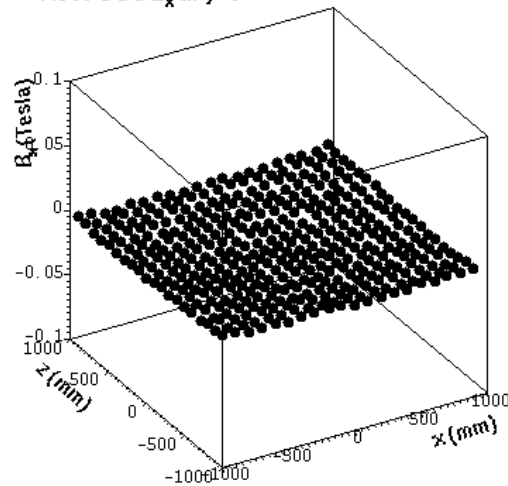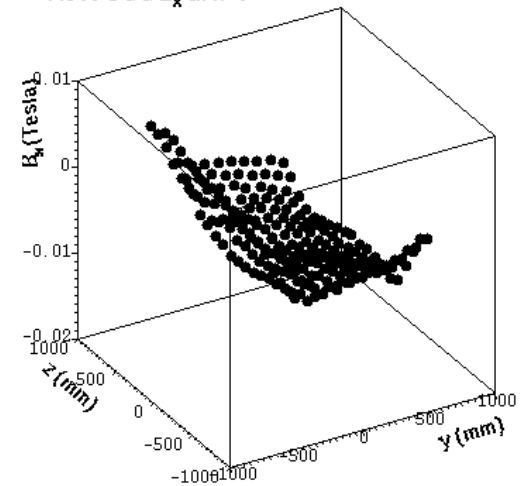
Reco JGG B_x field

JGG Field Plot Comparison B$_z$

MC B$_z$ ≠ Reco B$_z$

MC JGG B$_z$ field
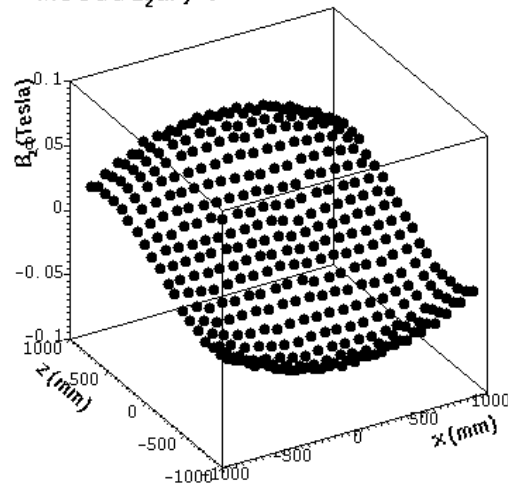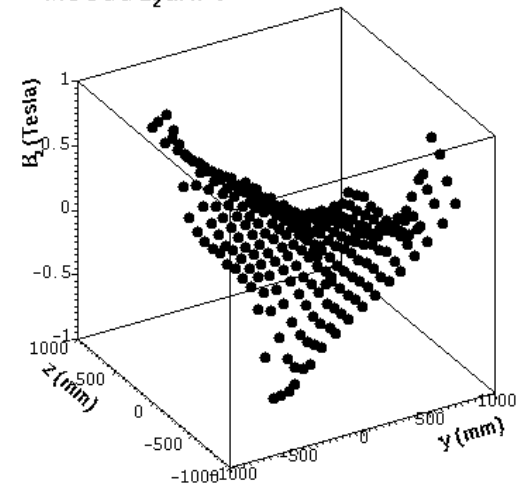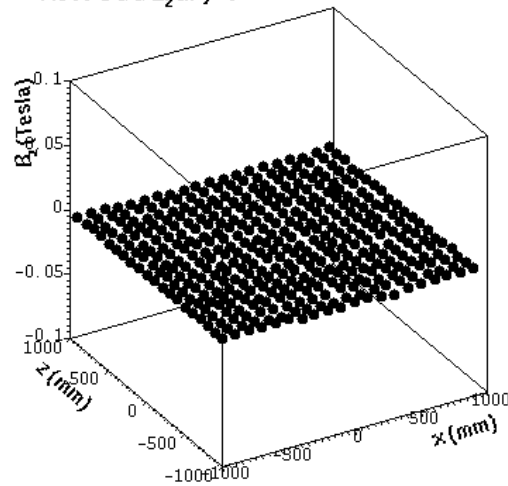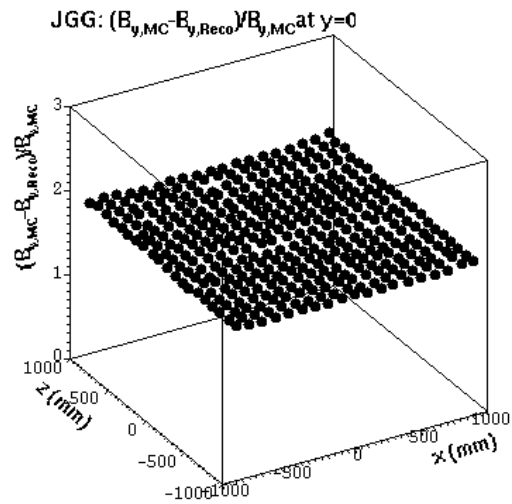

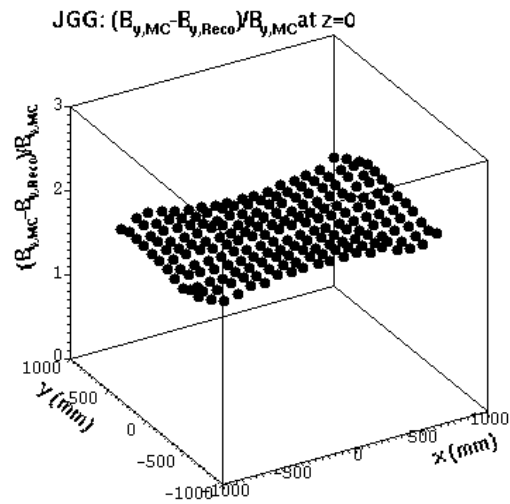y=0   z=0   x=0

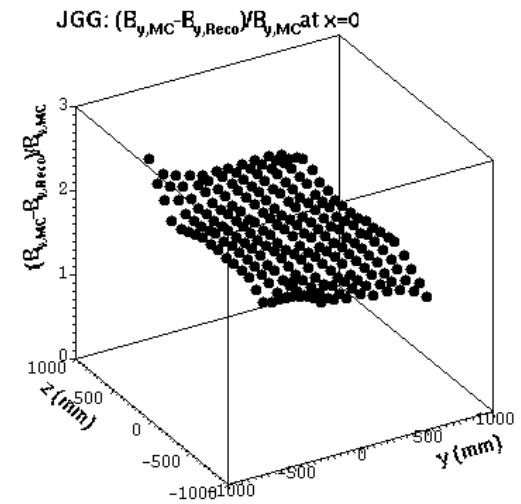Reco JGG B$_z$ field
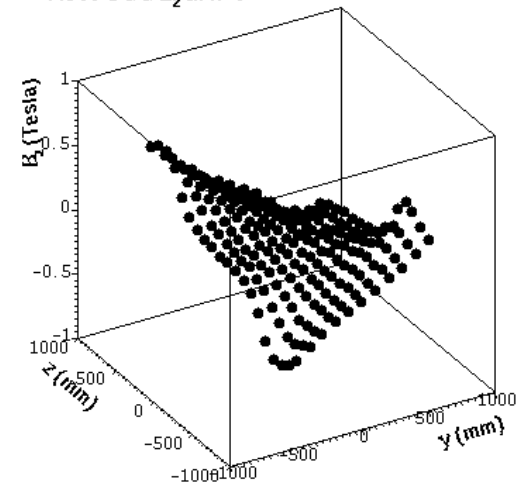
JGG Field: $(B_{y,MC} - B_{y,Reco})/B_{y,MC}$

$$B_{y,MC} \approx -B_{y,Reco}$$

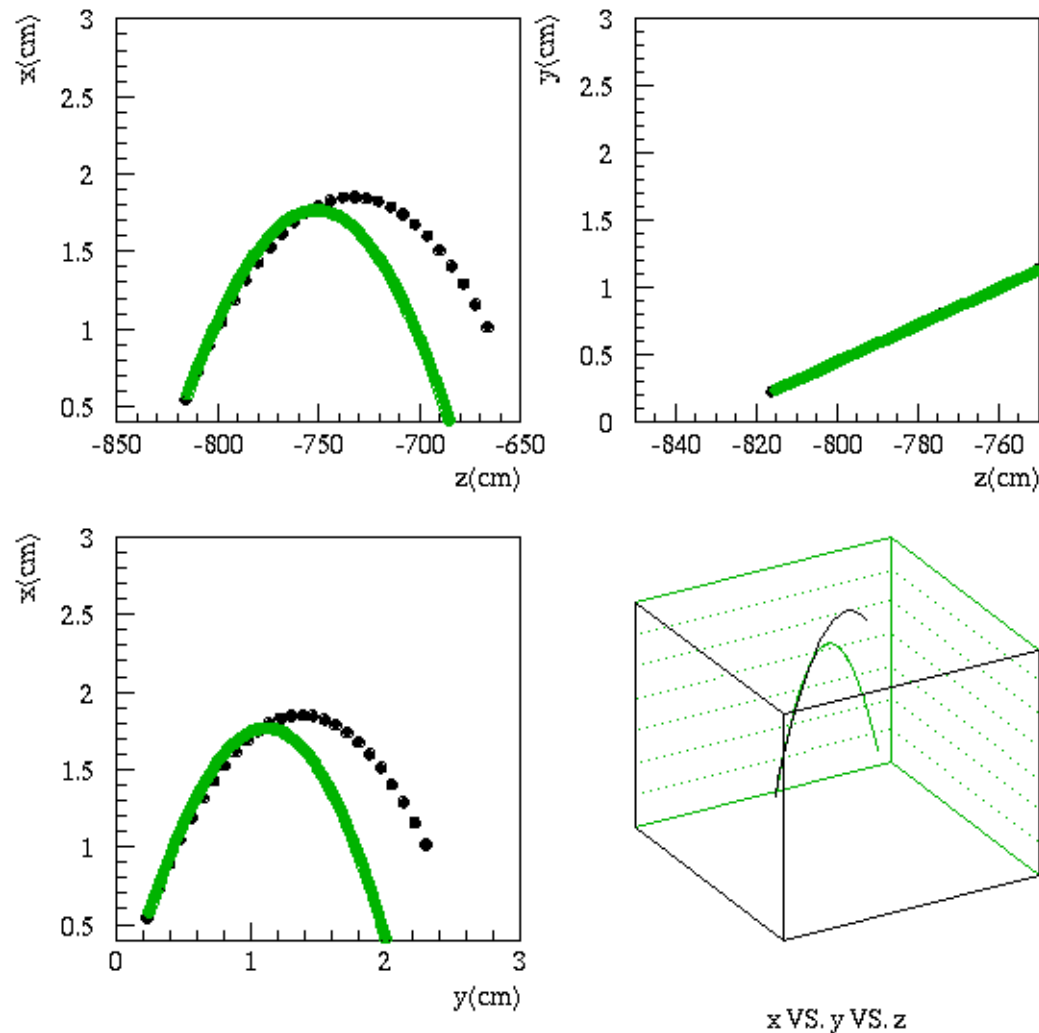y=0   z=0   x=0

Test 3: μ⁺ in JGG BField with By→-2×By in Reco BField

A muon+ in JGG Bfield (black --MC; green -- RECO) with By -> -2By in Reco

x VS. y VS. z

Conclusion

- Add ability to track a particle to DCs
- Full testing required
- BField needs to be corrected beforehand
  - About a factor of -1 difference in B_y